

SECTION III – GENERAL NOTES

A. PURPOSE

The intent of the Standard Home Earthquake Retrofit Plan is to promote public safety and welfare by reducing the risk of earthquake-induced damage in existing wood frame residential buildings. The requirements in this plan define a minimum recommended standard for the retrofit of these existing buildings. Damage to homes in past earthquakes show that incorrect or incomplete retrofits are as bad as having no retrofit at all. Use of this standard plan is intended to improve building performance during earthquake shaking, but will not necessarily eliminate earthquake damage. The primary purpose is to reduce the likelihood that these buildings will fall off their foundations.

B. SCOPE

The standard plan applies to one, two and three story light wood-frame residential buildings with raised wood floors meeting the following criteria as determined by the completion of the Home Assessment Checklist:

1. The maximum number of dwelling units and/or guest rooms is four.
2. The roof is made of standard lightweight roofing materials.
3. No portion of the building is constructed over a slope steeper than 3 horizontal to 1 vertical.
4. The building is supported at its perimeter by a continuous concrete or reinforced masonry footing and stem wall in good condition.
5. The pony wall heights do not exceed 48 inches in one or two story buildings and do not exceed 18 1/2 inches height in three story buildings.
6. The pony walls are sheathed with materials other than wood structural panels or diagonal sheathing.

C. GENERAL REQUIREMENTS

Permit requirements: All work shown on these plans requires a building permit.
Inspection requirements: All work is subject to inspection by the local building inspector. In general, this will involve two inspections. A final sign off by inspectors is required when the work is complete. If new concrete foundations are involved, an additional inspection will be required after all forming and placement of reinforcing, but before concrete pouring. In addition, if the contractor wishes to discuss construction specifics with the inspector, a separate inspection may be necessary.

D. DEFINITIONS

Anchor side plate: is a metal plate or plates used to connect the sill plate or floor framing to the side of a concrete stem wall when conditions prevent chemical anchor or expansion bolt installation vertically through the sill plate.

Approval: is current product acceptance under an ICCB (International Conference of Building Officials) evaluation report or equivalent.

Chemical anchor: is a fastener placed in hardened concrete that derives its holding strength from a chemical adhesive compound placed between the wall of the hole and the embedded portion of the anchor. Chemical anchor compounds are organic compounds comprised of resin and hardener that form adhesives when blended together. Examples of chemical adhesive compounds include epoxies, polyurethanes, polyesters, methyl methacrylate and vinyl esters.

Embedment depth: is the depth of the anchor into the concrete prior to setting of the anchor

Expansion bolt: is a mechanical fastener placed in hardened concrete designed to expand in a self-drilled or pre-drilled hole of a specified size and engage the sides of the hole in one or more locations to develop shear and/or tension resistance to applied loads without grout, adhesive or epoxy.

Installation torque: is the minimum moment applied to a torque-set anchor that creates the degree of anchorage required for full load values.

Minimum concrete edge distance: is the measure between the free edge of the concrete and the centerline of the bolt at which the concrete will not break away when the anchor is set or loaded in service. Minimum edge distances for anchors are given in the product approval.

Oriented strand board (OSB): is a mat-formed wood structural panel composed of thin rectangular wood strands or waters arranged in oriented layers and bonded with waterproof adhesive.

Pony wall: is a wood-framed stud wall extending from the top of the foundation to the underside of the lowest floor framing. Also called a cripple wall or a knee wall.

Snug tight: is the condition when the full surface of the plate washer is in contact with the wood member and begins to slightly indent the wood surface.

Structural panel: in the standard plan refers to a product composed primarily of wood and meeting the requirements of the United States Voluntary Product Standard PS 1 and PS 2, including all-veneer plywood and OSB.

Torque-set anchor: is an expansion bolt whose wedge or sleeve engages the concrete base mass in the drilled hole by the application of torque and where the amount of torque applied controls the degree of anchorage.

E. MATERIALS

Adhesive packaging: The packaging for each adhesive shall be marked with the manufacturer's name and address, lot number of date or packaging, shelf life or expiration date, name of the quality control agency, and instructions for installation. No adhesive shall be used after its expiration date.

Anchors, including chemical anchors and expansion bolts: all adhesive or expansion anchors shall have a minimum normal load capacity of 635 lbs. for 1/2 inch bolts and 980 lbs. for 5/8 inch bolts in 2000 psi concrete at the installed edge distance and depth of embedment. All proprietary anchors shall have current ICCB or equivalent approval.

Anchor side plate: All anchor side plates shall be of minimum 7 gauge steel (3/16 inch) and galvanized when exposed to weather. The minimum seismic adjusted load capacity for shear in the direction of the sill plate must meet or exceed a capacity of 1275 lbs when substituted for 5/8 inch bolts and 840 lbs when substituted for 1/2 inch bolts. Other products with lower approved capacities may be used if their required spacing is reduced proportionately by the ratio of their strength to the strength requirement above. For example, (400 lbs/840 lbs) x 72 in. o.c. = 34 in. o.c. instead of 72 in. o.c. for one-story using an anchor side plate with allowable values of 400 lbs instead of 840 lbs or greater. Anchor side plates shall be attached to the concrete stem wall with a minimum of two 1/2 inch approved anchors. The number of expansion or adhesive anchors used must have a total shear capacity in concrete equal or greater to the value for the foundation anchor requirement above.

Chemical anchor rod materials: All chemical anchors shall use all-thread rod manufactured from ASTM A36 or SAE 1018 material to meet the mechanical requirements of ASTM A307. All thread rods shall be free of oil, scale and rust. The use of smooth or partially threaded rods or bolts is prohibited.

Concrete: All new concrete for replacement footings shall be of 2500 psi minimum compressive strength. No special inspection is required.

Framing clips: All framing clips shall be of minimum 18 gauge galvanized steel, of 4-1/2 inch length and approved under ICCB or equivalent for wood frame construction. The seismic load capacity in the long direction must meet or exceed 450 lbs in dry lumber. The fasteners must be 12-8d common x 1-1/2 inch nails unless otherwise approved. #6 x 1-1/2 inch flat head wood screws may be used at existing rim joist, blocking or top plate connections.

Lumber: All new lumber installed for joist blocking shall be a minimum of nominal two inch Hemfir #2 or better as graded under Western Wood Products Grading Rules. All lumber in contact with concrete shall be pressure treated hem fir for new stem walls and for sill plate replacements over 10% of the wall length. Replacement of sill plate less than 10% of the wall length may use the same lumber species as the existing materials. All existing lumber shall be free of defects including dry rot, mildew, excessive warpage and insect infestation or damage. Damaged lumber must be replaced and the source of water or insect intrusion removed.

Plate washers: Square plate washers are required. Use 3/16 x 2 x 2 for 1/2 inch anchors and 1/4 x 2-1/2 x 2-1/2 for 5/8 inch anchors. Standard circular cut washers shall not be used to connect sill plates to concrete stem walls. Washers furnished with the proprietary anchors shall not be used. Beveled washers shall be used on anchors drilled at an angle exceeding 6 degrees from vertical and shall be placed over the plate washers.

Reinforcing bar: ASTM A615 Grade 40 or 60

Structural panels (Sheathing): All plywood shall be graded under United States Voluntary Product Standard UBC 23-2 and 23-3. All structural panel sheathing used for wall bracing shall be 1/2 inch APA Rated Sheathing, Oriented Strand Board or CDX. Sheathing of 4-ply or better is recommended. All structural panels used for joist blocking or shear transfer shall be 3/4 inch APA Rated Sheathing Exposure 1.

Structural panel fasteners: Nails shall be 8d common (131 inch x 2-1/2 inch) with full heads (281 inch) on interior or covered interior structural panel when plaster exists on the exterior side of the pony wall.

F. REPLACEMENT OF EXISTING FOOTINGS & STEM WALLS

1. Deteriorated, cracked or unreinforced masonry footings may be replaced as shown on this plan provided proper shoring is provided. The method of shoring and sequence of its construction shall be the responsibility of the person performing the work and shall not weaken the structure so as to be a threat to the safety of its occupants or possessors nearby.

2. When existing footings and stem walls are replaced in sections, the person performing the work shall take care to insure that all reinforcing steel shall be lapped a minimum of 24 inches and shall be dowelled into the existing concrete with adhesive or epoxy a minimum of 8 inches.

3. The repair of damaged footings or stem walls or the continued use of archaic building materials such as unreinforced masonry, requires that plans and calculations be prepared by a licensed architect or engineer.

G. ANCHOR BOLT INSTALLATION

1. General Requirements

(a) **Condition of existing concrete:** All concrete shall be fully cured and hardened, uncracked and in sound condition. Concrete with excessive cracking, deterioration or damage shall be replaced.
(b) **Condition of existing anchor bolts:** Existing sill plate anchor bolts cast in concrete and in sound condition shall be permitted to provide all or a portion of the sill plate connection required if the anchor bolt diameter and spacing meet or exceed the requirements in the Summary of Minimum Prescriptive Requirements and the sill plate is connected to a snug tight condition under the torque test requirement.
(c) **Drilling of the hole in concrete:** The drilled hole diameter and minimums for spacing, depth of hole and edge distance must comply with an ICCB Evaluation Report or equivalent approval and manufacturer's recommendations. All holes shall be drilled with carbide-tipped drill bits conforming to ANSI Specification B94-12-77 tolerances (1/2" = 0.650-0.650 inches; 5/8" = 0.650-0.660 inches). Non drill bits with reduced diameters below the ANSI tolerance limits shall not be used. All holes shall be driven as perpendicular as possible to the concrete surface. Right angle drill motors shall be used as needed to provide the proper hole orientation.
(d) **Choosing between expansion bolts or chemical anchors:** Expansion bolts or chemical anchors may be used interchangeably in concrete of average or better quality. Concrete of weaker quality may be indicated by spalling during drilling or setting of expansion bolts or failure of anchors to reach the minimum torque required. Chemical anchors must be used in weaker quality concrete. This requirement does not waive the need to replace existing concrete foundations from damaged, deteriorated, or of unsuitable quality.

2. Requirements for Installing Chemical Anchors.

(a) **Cleaning of the hole:** The hole must be cleaned with a jet of compressed air and a nylon brush. Wire brushes shall not be used to clean the hole. No debris or dust shall remain in the hole.
(b) **Placement of the adhesive:** The resin, filler and hardener shall be thoroughly mixed before placement in the hole unless approved to be mixed in the hole. Compounds dispensed through a state mixing nozzle must be of uniform color. Ensure uniform color by extruding a small amount of adhesive until color uniformity is achieved. Adhesive added to the hole shall be applied at a slow enough rate to prevent the formation of air voids. The threads and annular space about the threaded rod in both the concrete and any existing wood sill plate. Adhesives must be installed within the manufacturer's recommended temperature range for the air and concrete.
(c) **Placement of the threaded rod:** The all thread rod, completely free of rust, scale or oil, shall be installed to the full depth of the hole. The rod shall be turned counter-clockwise sufficiently during installation for the adhesive to engage the threads. The length of the rod shall extend a minimum of one rod diameter above the nut after tightening.
(d) **Adhesive setting time:** No torquing of the anchors shall occur until the adhesive has cured for the recommended time based on the temperature as shown in the manufacturer's instructions. Care must be used to insure that the anchor bond is not disturbed until the adhesive has sufficiently cured.
(e) **Torque requirements:** A minimum torque setting of 30 ft. lbs. for 1/2 inch anchors and 40 ft. lbs. for 5/8 inch anchors is required for all chemical anchors for the snug tight condition unless this value exceeds the maximum torque allowed by the approval. In those cases, the torque shall be set to its maximum allowable value.

3. Requirements for Installing Expansion Bolts

(a) **Drilling of the hole:** Care must be used to insure that the drilled hole carefully matches the depth and diameter requirements for the expansion bolt type. The depth of the hole cannot exceed 2/3 of the concrete thickness in the direction of the drilled hole. This is critical at the application of anchor side plates to full height concrete stem walls.
(b) **Cleaning of the hole:** Unless otherwise required by the manufacturer's recommendations, the drilled hole may be deepened to allow the concrete debris to remain in the hole provided the hole does not exceed 2/3 of the concrete thickness in the direction of the drilled hole. The depth required for embedment must be free of debris. This rule does not apply to drop-in anchors that rely on the bottom of a clean drilled hole to set the expansion element.
(c) **Torque requirements:** A minimum torque setting equal to the installation torque or 30 ft. lbs. for 1/2 inch bolts and 40 ft. lbs. for 5/8 inch bolts, which ever is greater, is required for all expansion bolts unless this value exceeds the maximum torque allowed by the approval. In those cases, the torque shall be set to its maximum allowable value.

H. ANCHOR SIDE PLATE INSTALLATION

1. Anchor side plates may be substituted for vertically placed chemical anchors or expansion bolts only when conditions prevent anchor or bolt installation vertically through the sill plate even with a right angle drill motor. This condition commonly occurs when there is no pony wall or one of greatly reduced height.
2. A minimum of two anchor side plates must be installed on each piece of sill plate 32 inches or longer. The nearest edge of the plate shall be installed a minimum of 8 inches but not more than 12 inches from the end of the sill plate.
3. Installation of the anchor bolts in the existing concrete shall follow the information in Section G except as noted herein. Care shall be used to insure the drilled hole depth does not exceed 2/3 of the stem wall thickness when using expansion bolts. Cleaning of the hole may be required for these expansion bolts due to the limited stem wall thickness available to overdrill the hole.
4. Log screws and wood screws used to attach anchor side plates shall be installed as follows:
(a) The log or wood screw shall be located at the center of the plate thickness and shall penetrate the sill plate a minimum of 2-1/2 inches.
(b) Lead holes shall be pre-drilled for the threaded portion of the screw as follows:
Log screw: The pre-drill diameter for the lead hole shall not exceed 70% of the shank diameter and shall be drilled to the full depth of penetration of the log screw. Use a 1/4 inch diameter drill bit for 3/8 inch log screws and 1/8 inch drill bit for 1/4 inch log screws.
Wood screw: The pre-drill diameter for the lead hole shall be about 7/8th of the diameter of the screw at the root of the thread (minimum solid diameter). Use 1/8 inch for #14 screws.
(c) **Clearance holes** shall also be drilled for the solid portion of the shank as follows:
Log screw: The clearance hole shall be equal in depth and diameter to the solid portion of the shank.
Wood screw: The clearance hole shall be about 7/8ths of the diameter of the solid portion of the shank. Use a 3/16 inch drill bit for #14 screws.
(d) The threaded portion of the log or wood screw shall be inserted in its lead hole by turning with a wrench and not by driving with a hammer or other blunt object.
(e) soap or other lubricant shall be used on the log or wood screws or in the lead holes for ease of installation and to prevent damage to the log screw.
5. Wood shims may be required to fill the space between the inside edge of the sill plate and the edge of the concrete stem wall. See manufacturer's instructions.

Ⓢ Refers to general notes, typical.

Table 1: Summary of Minimum Prescriptive Requirements

STORIES ABOVE FOUNDATION WALL (B)	ANCHOR SIZE AND SPACING Ⓢ (E, G, H)	SHORT SILL PLATES (E, G, H)			REQUIREMENTS FOR PONY WALL BRACING (I)	FRAMING CONNECTIONS (E)	JOIST BLOCKING (E,I)
		6 ft. to < 12 ft.	30 in. to < 6 ft.	< 30 in. near center			
ONE	1/2 inch at 6 ft. on center maximum	3 anchors	2 anchors	1 anchor	Total bracing not less than 50% of wall length. Install part of bracing at each end of wall section and remainder equally spaced in between ends.	32 in. on center maximum	On alternate joists
TWO	1/2 inch at 4 ft. on center maximum or 5/8 inch at 6 ft. on center maximum	4 anchors for 1/2 in. bolts; 3 anchors for 5/8 in. bolts	2 anchors	1 anchor	Total bracing not less than 70% of wall length. Install part of bracing at each end of wall section and remainder equally spaced in between ends.	24 in. on center maximum	On alternate joists and on every joist above wall bracing
THREE	5/8 inch at 4 ft. on center maximum or 1/2 inch at 2 ft. 8 in. on center maximum	4 anchors	2 anchors	1 anchor	Install bracing over 100% of the wall length.	16 in. on center maximum	On all joists

March 1999

Standard Home Earthquake Retrofit Plan Set

EARTHQUAKE DAMAGE REDUCTION IN EXISTING WOOD FRAME RESIDENTIAL BUILDINGS WITH WEAK PONY WALLS AND UNBOLTED SILL PLATES

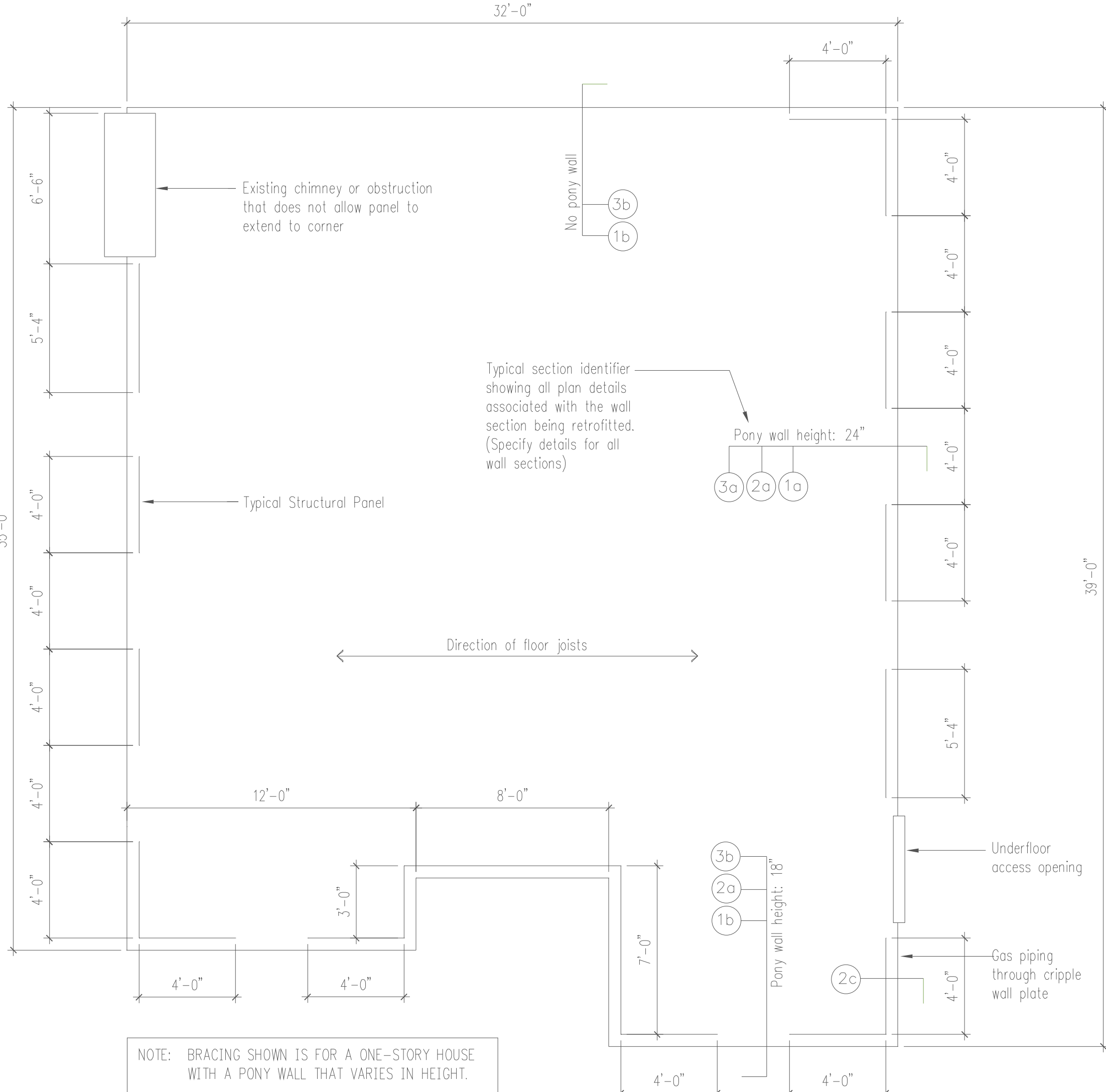
Applicant Plan Sheet

SECTION I – PERMIT APPLICATION INSTRUCTIONS

1. Review all information provided in the Standard Home Earthquake Retrofit Permit Application Packet, including the Home Assessment Checklist, the Applicant Plan Sheet (sheet 1), the Plan Detail Reference sheet (sheet 2), and any additional fact sheets or information provided to assist you.
2. Complete the Home Assessment Checklist to determine if your building qualifies to use the simplified construction methods in the Standard Home Earthquake Retrofit Plan. The Guide to Completing the Home Assessment Checklist (Booklet 2 of the Home Retrofit Information Series) provides detailed information to help you complete the checklist.
3. Submit the completed checklist to a participating Seattle Project Impact lender with your loan application. To qualify for a Seattle Project Impact retrofit loan, your retrofit project must meet the Minimum Prescriptive Requirements in the Standard Home Earthquake Retrofit Plan (see Section III). Final loan approval depends on obtaining a building permit.
4. Draw your Earthquake Retrofit Plan in the space provided in Section IIb. Mark the scale used. The Guide to Completing Your Earthquake Retrofit Plan (Booklet 3 of the Home Retrofit Information Series) provides detailed information on how to draw your plan, including drawing a foundation outline and selecting plan details from the Reference sheet, and determining the structural panel layout.
5. Submit the number of copies required by your building department of (a) the Applicant Plan Sheet showing your completed earthquake retrofit plan, (b) the Plan Detail Reference sheet, and (c) any additional plan details addressing conditions not addressed by the Standard Plan. Appendix D of Booklet 3 provides plan details for several common conditions. Additional plan details may need to be prepared for submission to the building department by a contractor, architect, or engineer for conditions not addressed by the Standard Home Earthquake Retrofit Plan. Permit approval may take longer if additional plan details are needed.

SECTION II – EARTHQUAKE RETROFIT PLAN INSTRUCTIONS

1. Help.
Refer to the Guide to Completing Your Earthquake Retrofit Plan (Booklet 3, Home Retrofit Information Series) for detailed instructions on how to prepare your plan.
2. Measure and Mark Existing Conditions.
Draw an outline of the building's foundation in the space provided (Section IIb). Mark the scale used. Show chimneys, crawlspace access, and any other gaps in the foundation wall. Note the height of all pony walls. Mark the direction of run (orientation) of all floor joists and beams on your foundation outline. For completeness show an outline of porches, garages, or additions that lack a foundation using a dashed line. Refer to the "SAMPLE PLAN" (Section IIa) for guidance.
3. Select and Mark Plan Detail Numbers.
For each wall segment on your Earthquake Retrofit Plan, mark on the foundation outline the number of the plan detail(s) that you will use to complete your retrofit project. The Plan Detail Reference Guide (Sheet 2) provides plan details for common building conditions that meet the minimum prescriptive requirements in the standard plan. Plan details for additional conditions not included in the Standard Plan are provided in Appendix D of Booklet 3 as a guide.
4. Determine and Mark Wall Bracing Layout.
Use the Summary of Minimum Prescriptive Requirements (Section III) to determine the amount and placement of pony wall bracing. Show the layout of the structural panels you will use to brace the pony walls on the foundation outline.
5. You have now completed your Earthquake Retrofit Plan.

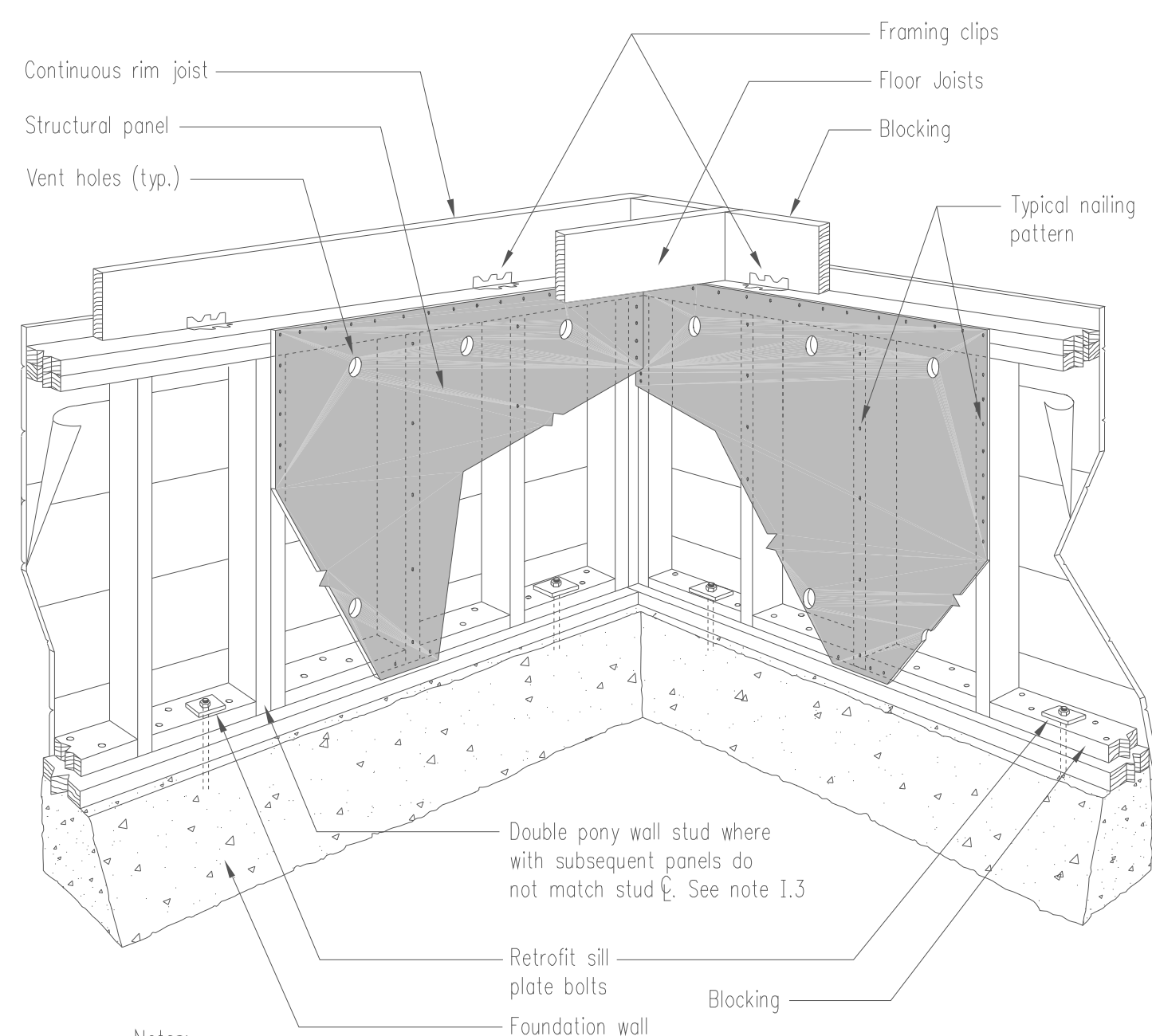
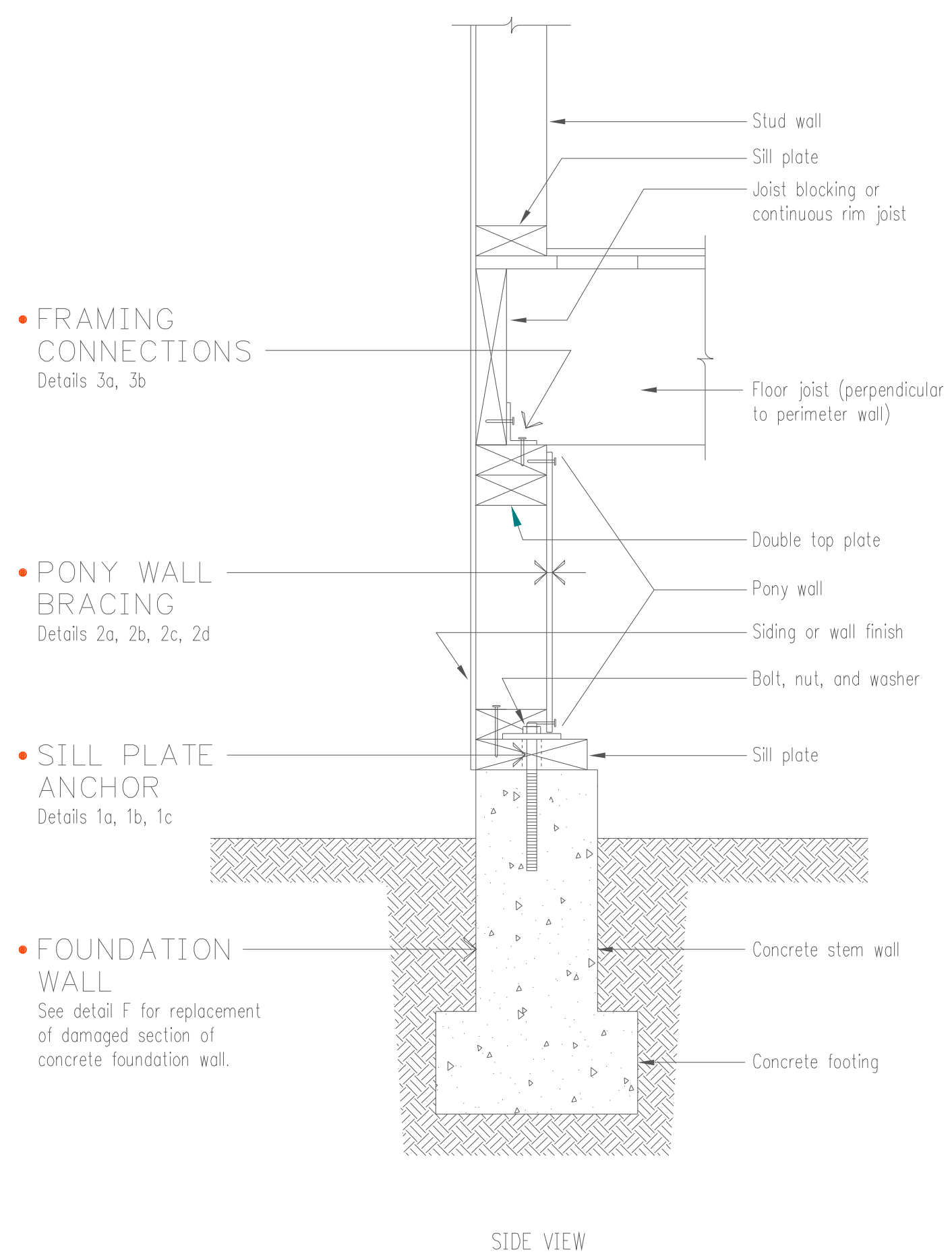


• FRAMING CONNECTIONS
Details 3a, 3b

• PONY WALL BRACING
Details 2a, 2b, 2c, 2d

• SILL PLATE ANCHOR
Details 1a, 1b, 1c

• FOUNDATION WALL
See detail F for replacement
of damaged section of
concrete foundation wall.



- Notes:
1. This sketch shows a sample wall section that has undergone a typical seismic strengthening retrofit.
 2. This is a general sketch and is not intended to supersede requirements contained in the Standard Home Earthquake Retrofit Plan or in the specific installation details.

FRONT VIEW (Isometric)

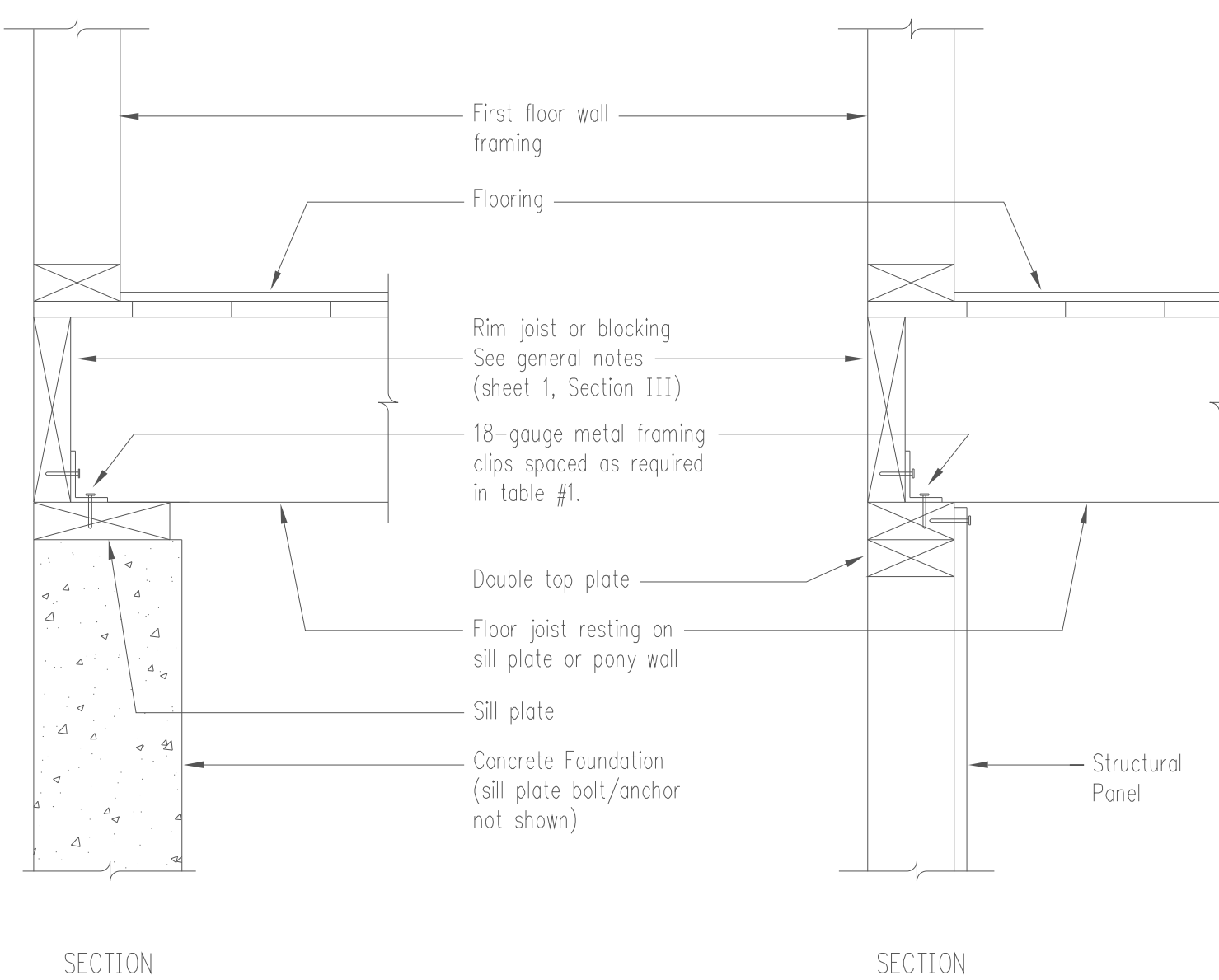
TYPICAL WALL RETROFIT

Refer to Booklet 3, Appendix D

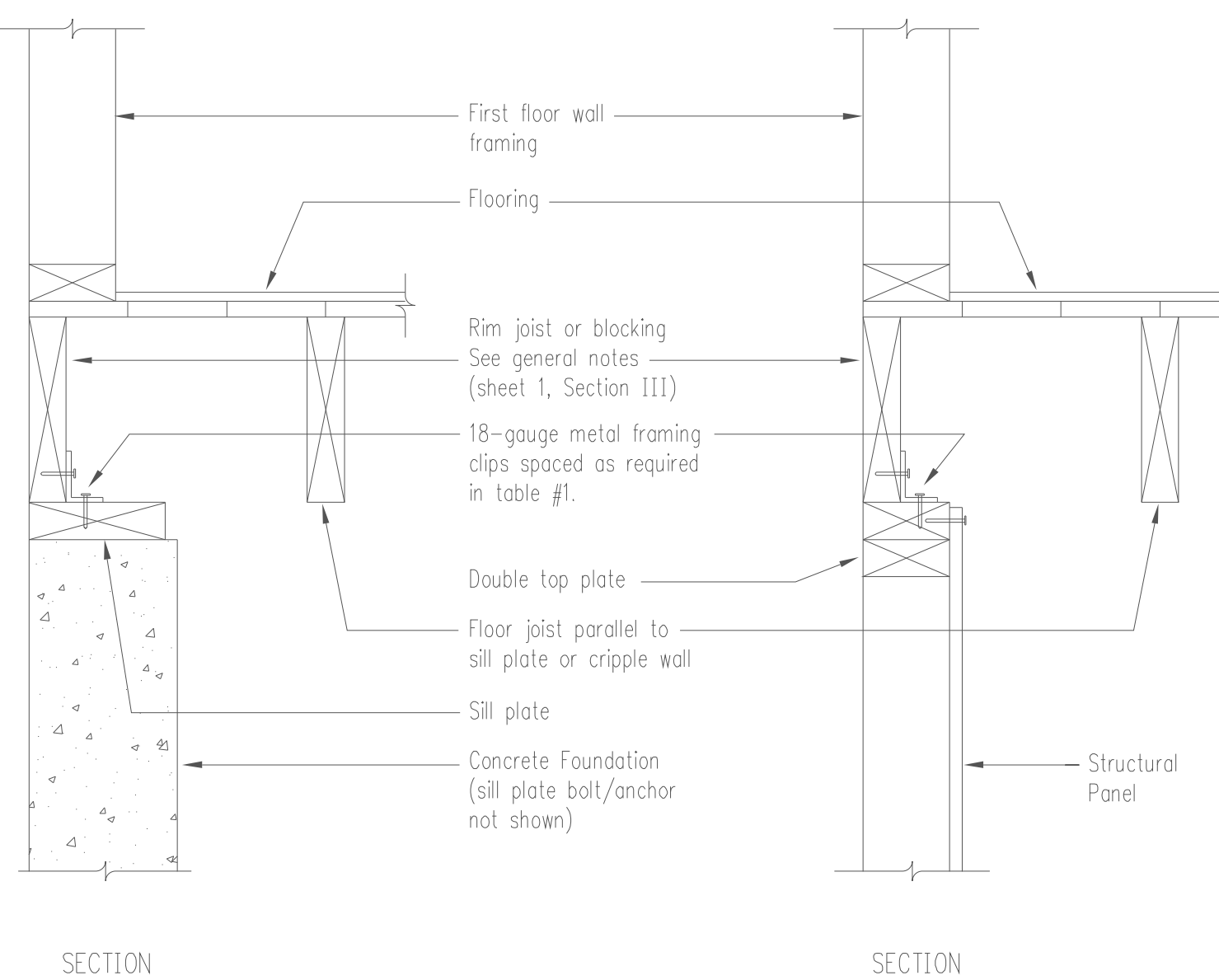
- D-1-1a Anchorage for joists supported on concrete where joists are perpendicular to foundation wall.
- D-1-1b Anchorage for joists supported on concrete where joists are parallel to foundation wall.
- D-1-1c Sill plate bolting where no floor joists occur.
- D-3-3a Lack of blocking above cripple wall at cantilevered floor.
- D-3-3b No cripple wall top plate - rim joist rests directly on pony wall studs.
- D-3-3c No sill plate - rim joist rests directly on concrete.
- D-3-3d Inadequate space between the rim joist and adjoining floor joist to install framing clips.

NOTE:
These details provide a guide for the retrofit of selected conditions in existing houses that are not addressed by the Standard Plan.

ADDITIONAL PLAN DETAILS

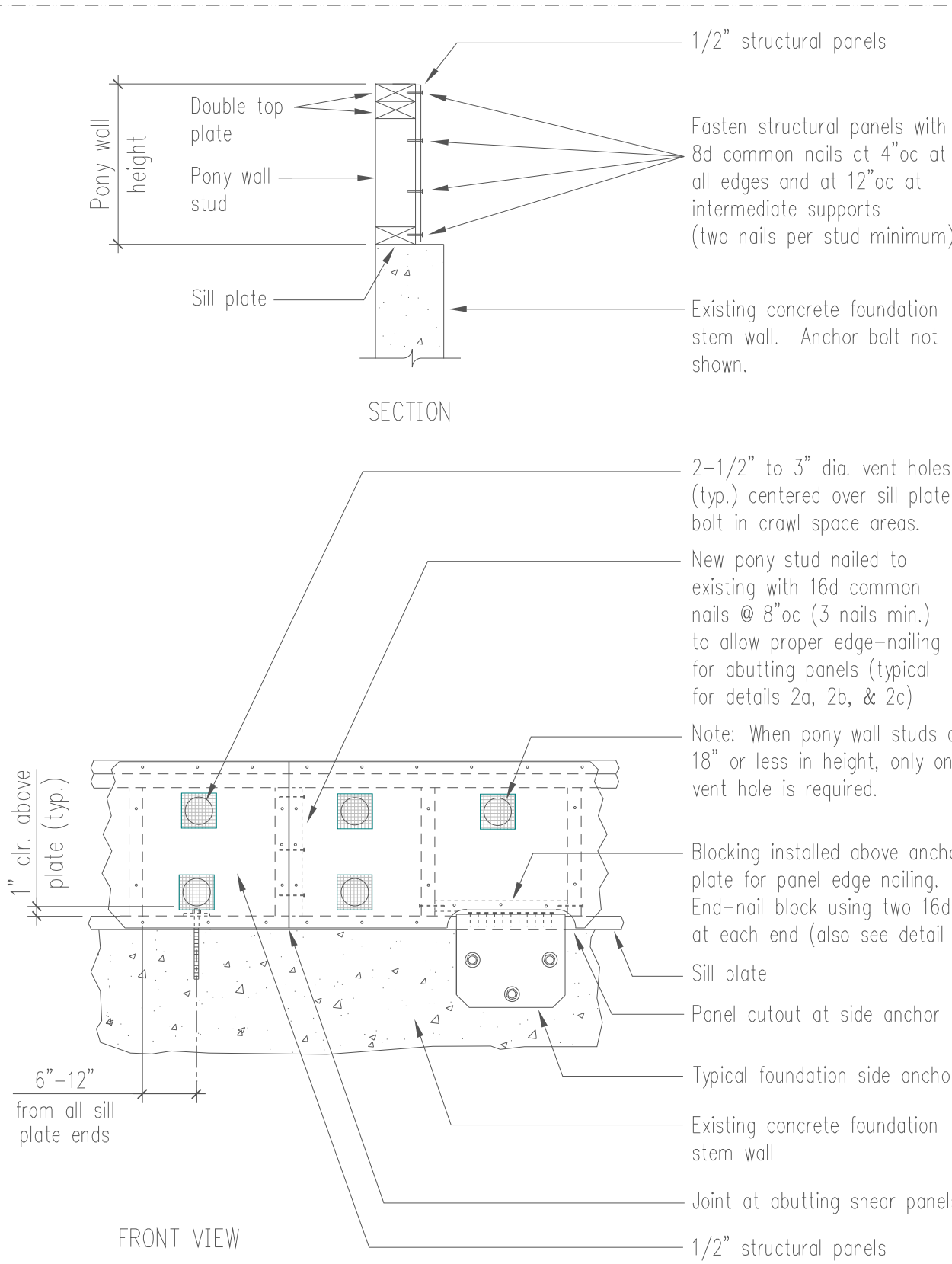


3a FLOOR JOIST PERPENDICULAR TO SILL PLATE OR PONY WALL

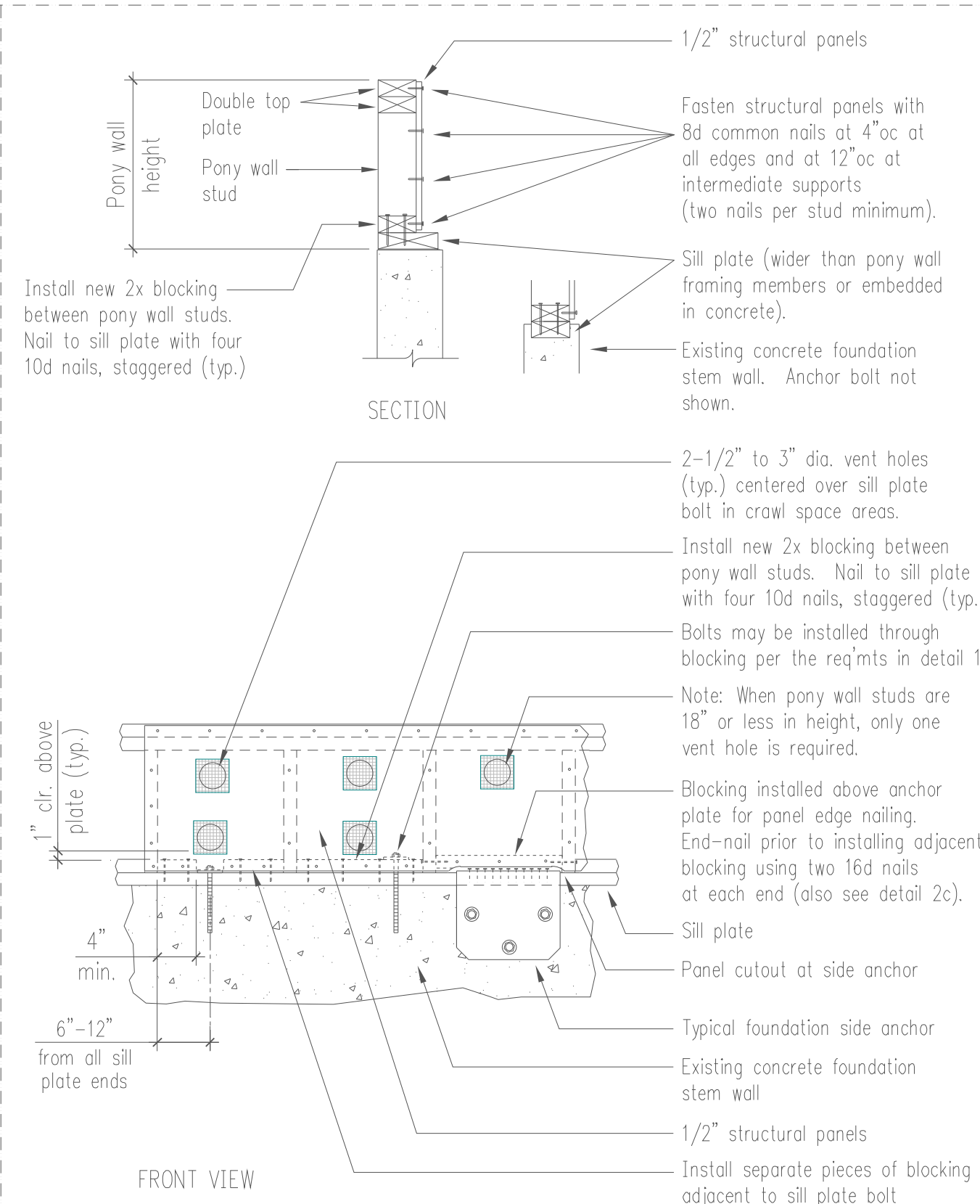


3b FLOOR JOIST PARALLEL TO SILL PLATE OR PONY WALL

3 FLOOR FRAMING CONNECTION DETAILS

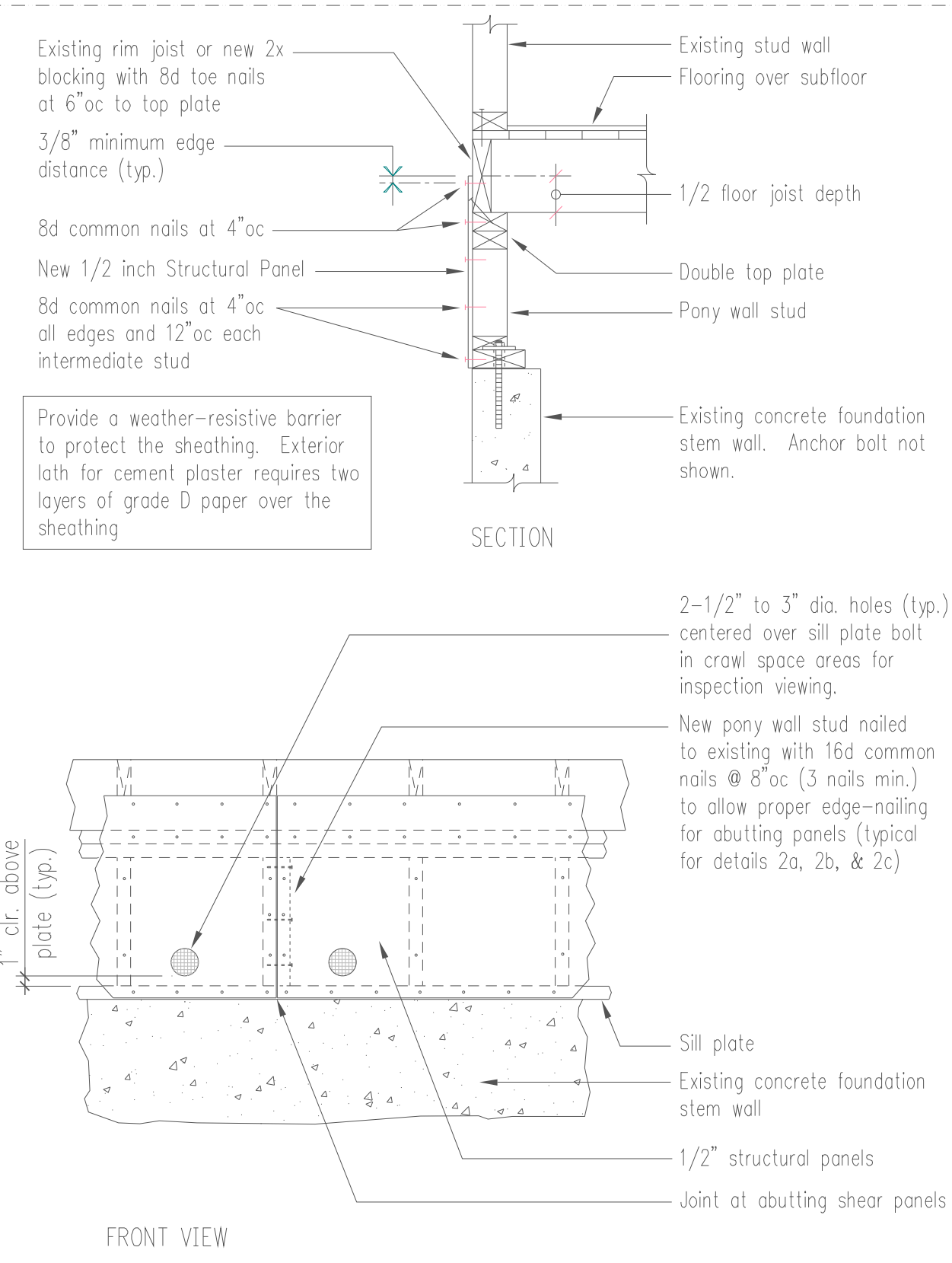


2a SILL PLATE SAME WIDTH AS PONY WALL



2b SILL PLATE WIDER THAN PONY WALL

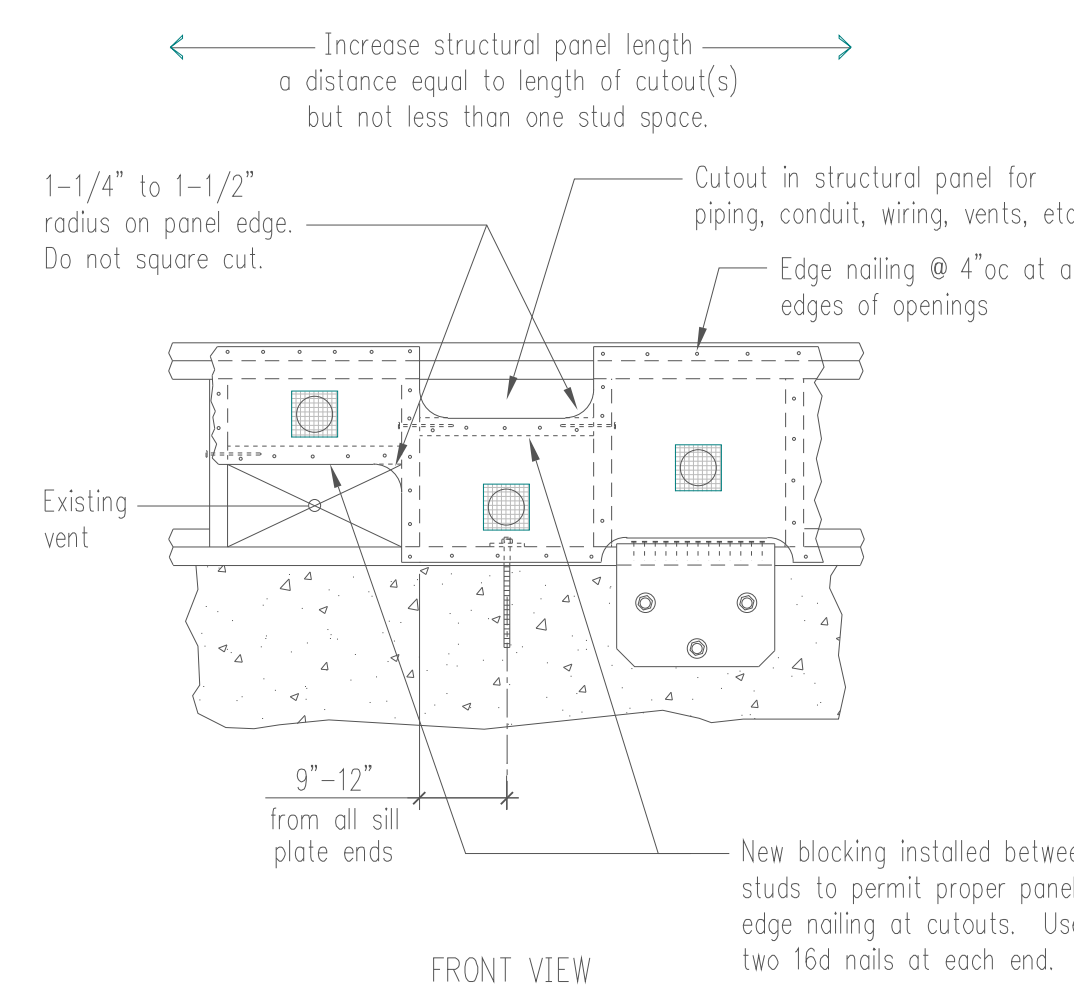
2 PONY WALL BRACING DETAILS



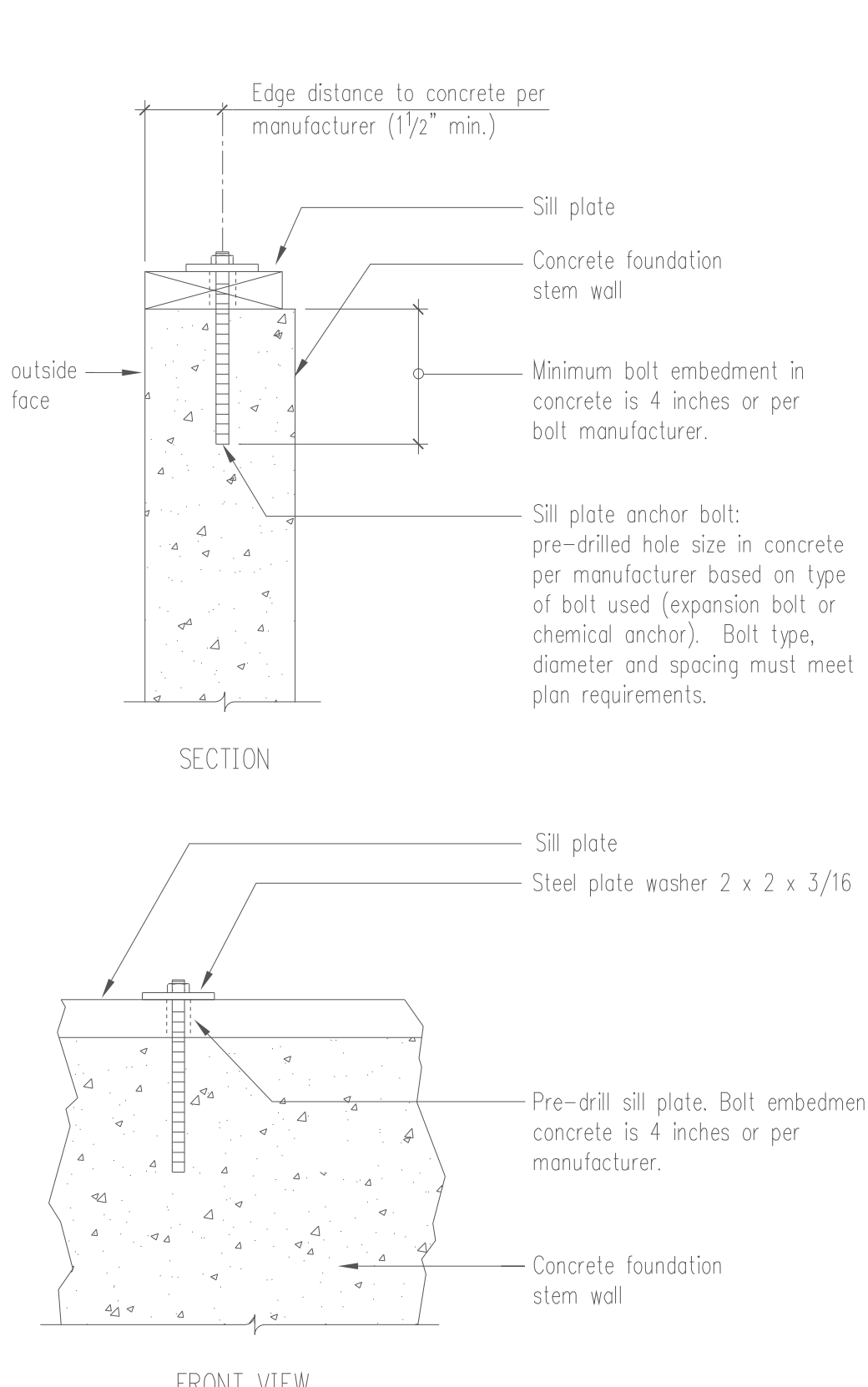
2c STRUCTURAL PANEL INSTALLED ON EXTERIOR FACE OF PONY STUDS

TYPICAL PONY WALL BRACING NOTES:

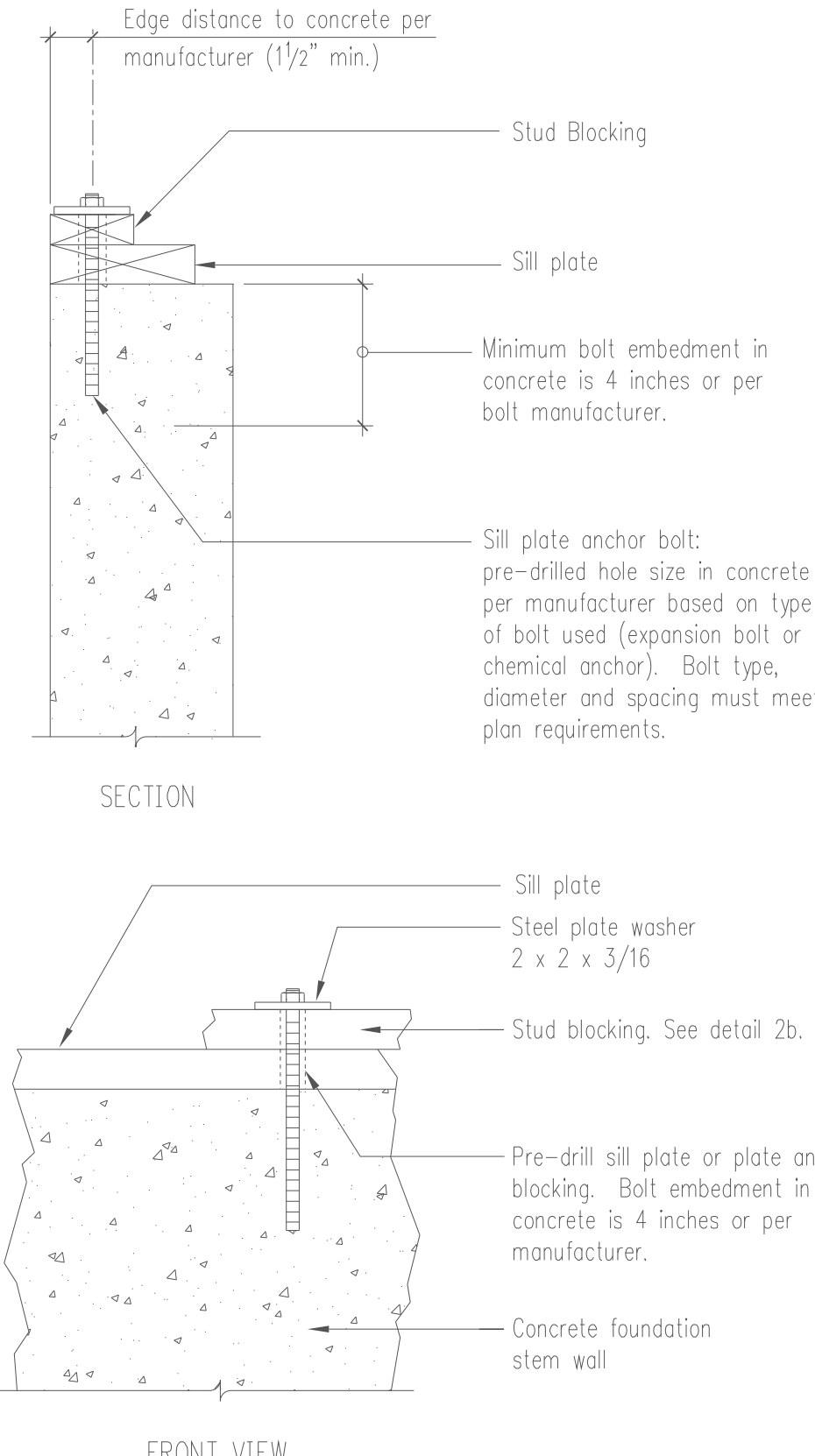
1. Structural panels shall be 1/2" CDX, Oriented Strand Board, or Structural II and shall be installed in accordance with the size, spacing, and hardware specifications in Details 2a through 2d and plan requirements (see sheet 1, section III).
2. Nails: All 8d and 10d nails shall be "common" nails with 8d shank diameter equal to .131 inches and 10d shank diameter equal to .146 inches.
3. Leave screens for ventilation holes at anchors unfastened until the anchors are inspected. No vent holes are required in heated areas, such as finished basements, or exterior panel installations.



2d PANEL CUTOUTS AND NOTCHING



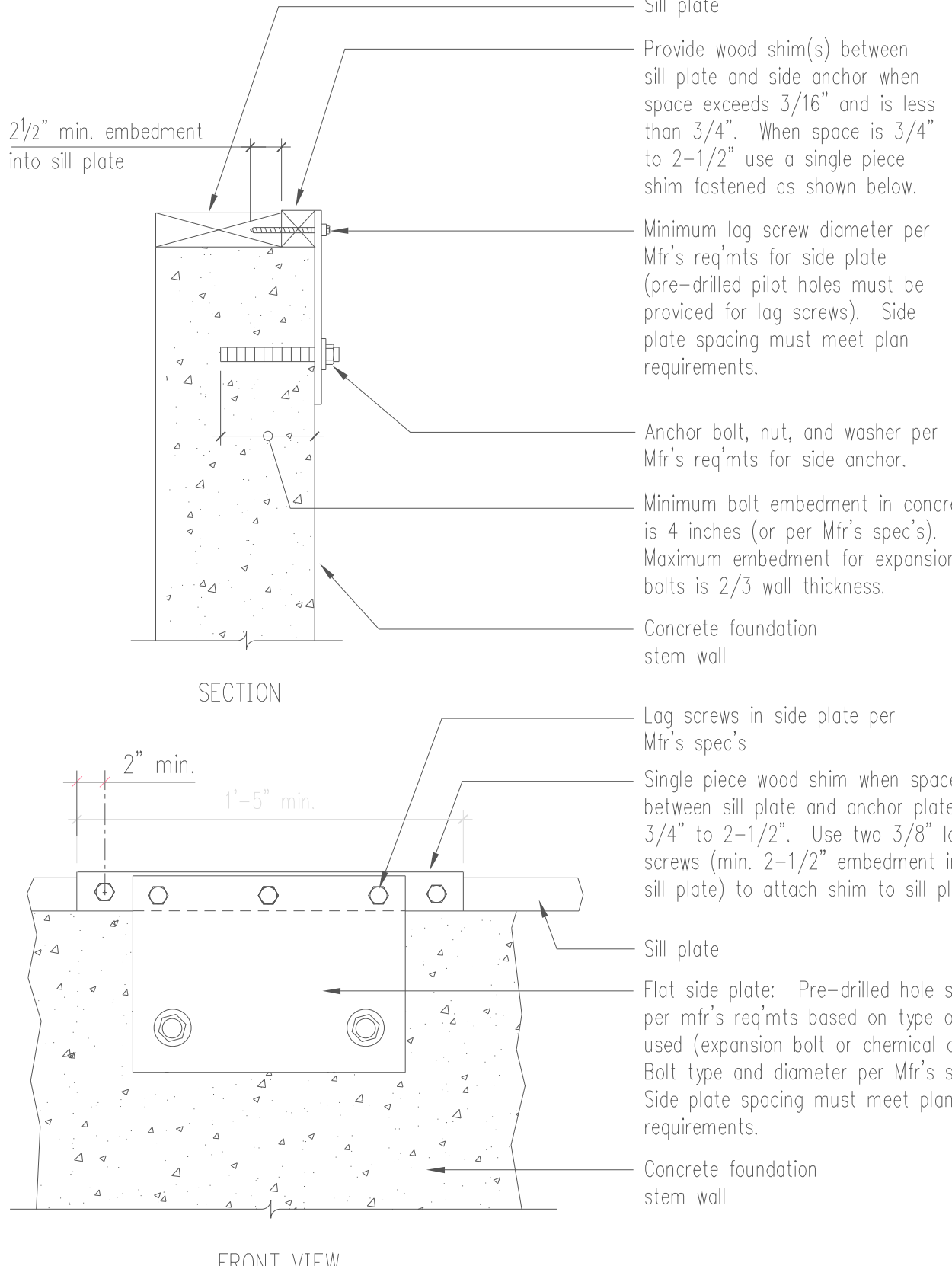
1a VERTICAL ANCHOR DETAIL (sill plate width = pony wall width)



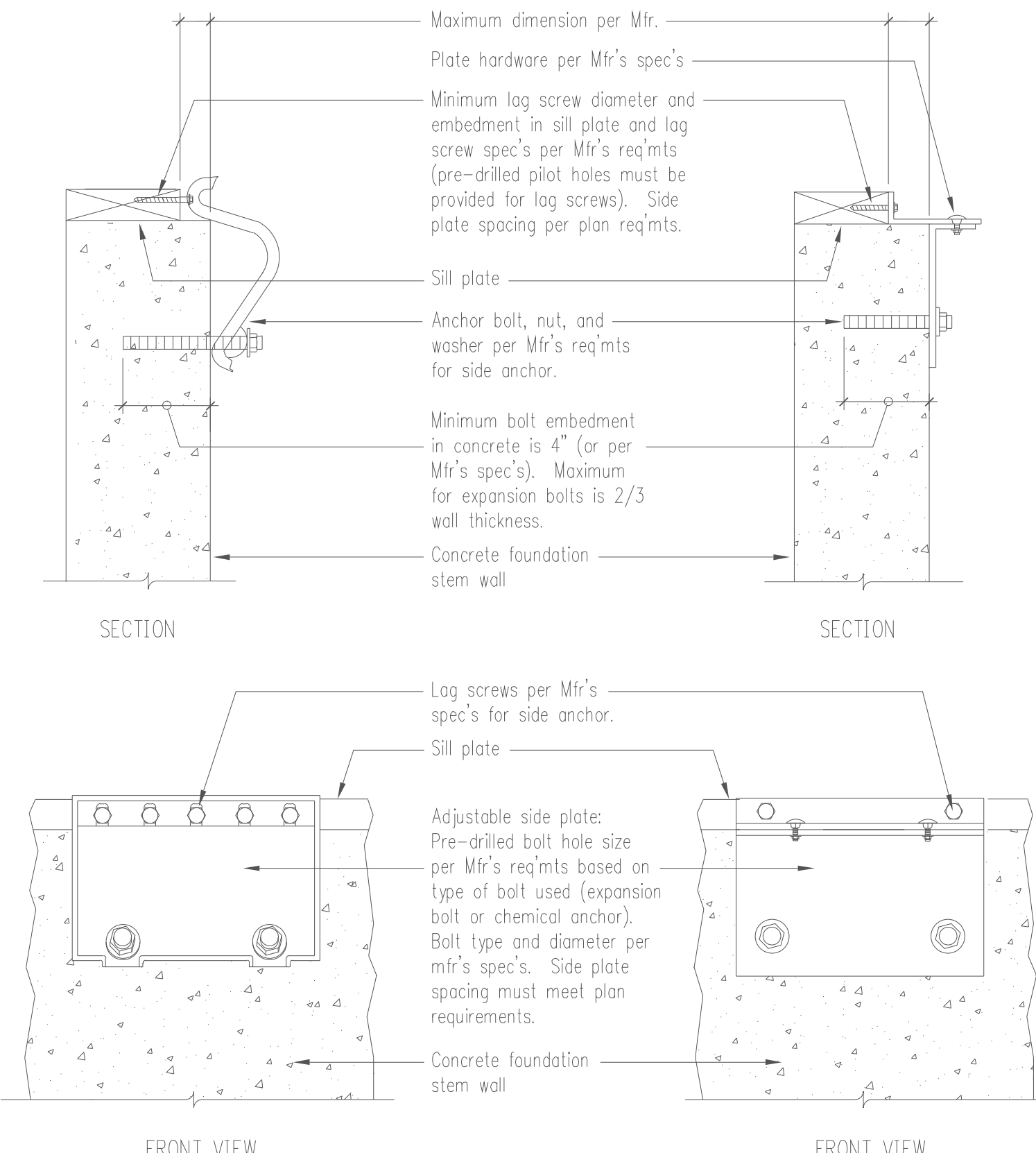
1b VERTICAL ANCHOR DETAIL (sill plate wider than pony wall)

1 SILL PLATE ANCHOR DETAILS

- See Applicant Planning Guide (Sheet 1) for materials, installation, and spacing requirements (sheet 1, Section III).
- Expansion bolts shall not be used when installation causes surface cracking of the foundation wall at the location of the bolt.



1c SIDE ANCHOR DETAIL - Flat Side Plate No pony wall



1d SIDE ANCHOR DETAIL - Adjustable Side Plates No pony wall

1 SIDE ANCHOR DETAILS